

An Axial-Vector Photon in a Mirror World

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Abstract

The unity of symmetry laws emphasizes, in the case of a mirror CP-even Dirac Lagrangian, the ideas of the left- and right-handed axial-vector photons referring to long- and short-lived bosons of true neutrality, respectively. Such a difference in lifetimes expresses the unidenticality of masses, energies and momenta of axial-vector photons of the different components. They define the unified field theory equation of C-odd particles with an integral spin. Together with a new equation of a theory of truly neutral particles with the half-integral spin, the latter reflects the availability in their nature of the second type of the local axial-vector gauge transformation responsible for origination in the Lagrangian of C-oddity of an interaction Newton component giving an axial-vector mass to all the interacting particles and fields. The mirror axial-vector mass, energy and momentum operators constitute a CP-invariant equation of quantum mechanics, confirming that each of them can individually influence on matter field. Thereby, findings suggest at the level of the mass-charge structure of gauge invariance a new equation for the C-noninvariant Lagrangian.

1. Introduction

Between nature of elementary particles and matter fields there exists a range of fundamental symmetries, which require to raise the question about axial-vector photons having with truly neutral fermions a C-noninvariant interaction. Their presence [1] restores herewith a broken gauge invariance of the Dirac Lagrangian of the unified field theory of C-odd particles.

As a consequence, the left (right)-handed neutrino of true neutrality in the field of axial-vector emission can be converted into the right (left)-handed one without change of his own flavor. These interconversions together with the unity of flavor and gauge symmetry laws [2] express the unidenticality of masses, energies and momenta of truly neutral neutrinos of the different components. However, such a possibility, as was noted in [3] for the first time, is realized only at the spontaneous mirror symmetry violation of axial-vector types of fermions. In other words, the left-handed neutrino of true neutrality and the right-handed axial-vector antineutrino are of long-lived leptons of C-oddity, and the right-handed truly neutral neutrino and the left-handed axial-vector antineutrino refer to short-lived C-odd fermions.

This difference in lifetimes establishes a new CP-even Dirac equation and thereby describes a situation when the mass, energy and momentum come forward in nature of truly neutral types of particles as the flavor symmetrical matrices

$$m_s = \begin{pmatrix} 0 & m_A \\ m_A & 0 \end{pmatrix}, \quad E_s = \begin{pmatrix} 0 & E_A \\ E_A & 0 \end{pmatrix}, \quad \mathbf{p}_s = \begin{pmatrix} 0 & \mathbf{p}_A \\ \mathbf{p}_A & 0 \end{pmatrix}, \quad (1)$$

$$m_A = \begin{pmatrix} m_L & 0 \\ 0 & m_R \end{pmatrix}, \quad E_A = \begin{pmatrix} E_L & 0 \\ 0 & E_R \end{pmatrix}, \quad \mathbf{p}_A = \begin{pmatrix} \mathbf{p}_L & 0 \\ 0 & \mathbf{p}_R \end{pmatrix}, \quad (2)$$

where an index A denotes the block matrix.

But here we must recognize that the same particle has no simultaneously both vector C-even and axial-vector C-odd charges. Such an order, however, corresponds to the fact that the same photon may not be simultaneously both a vector gauge boson and an axial-vector one. Thereby, it opens in principle the possibility for the classification of elementary objects with respect to C-operation, which reflects the availability in nature of the two types of particles and fields of C-invariance and C-noninvariance [2].

The mass, energy and momentum of the neutrino of a C-even charge are strictly vector (V) type [4]. In contrast to this, the neutrino of a C-odd electric charge [5] has the mass, energy and momentum of an axial-vector (A) nature [3]. Therefore, the matrices (1) and (2) refer doubtless only to those elementary particles in which the vector C-even properties are absent.

Of course, these matrices from the point of view of nature itself give the right to write the unified field theory equation of truly neutral types of particles with the spin 1/2 as a unification of the structural parts of their four-component wave function $\psi_s(t_s, \mathbf{x}_s)$ in a unified whole

$$i\frac{\partial}{\partial t_s}\psi_s = \hat{H}_s\psi_s. \quad (3)$$

So it is seen that

$$\hat{H}_s = \alpha \cdot \hat{\mathbf{p}}_s + \beta m_s, \quad (4)$$

and the sizes of m_s , E_s and \mathbf{p}_s correspond in a mirror presentation [3] of matter fields to the quantum axial-vector mass, energy and momentum operators

$$m_s = -i\frac{\partial}{\partial \tau_s}, \quad E_s = i\frac{\partial}{\partial t_s}, \quad \mathbf{p}_s = -i\frac{\partial}{\partial \mathbf{x}_s}. \quad (5)$$

The presence of an index s in (1), (4) and (5) implies the unidenticality of the space-time coordinates (t_s, \mathbf{x}_s) and the lifetimes τ_s for the left ($s = L = -1$)- and right ($s = R = +1$)-handed particles. Then it is possible, for example, to use [3] any of earlier experiments [6,7] about a quasielastic axial-vector mass as an indication in favor of an axial-vector mirror Minkowski space-time.

We see in addition that the Dirac matrices $\gamma^\mu = (\beta, \beta\alpha)$ for the case $\partial_\mu^s = \partial/\partial x_\mu^s = (\partial/\partial t_s, -\nabla_s)$ when

$$\partial_\mu^s = \begin{pmatrix} 0 & \partial_\mu^A \\ \partial_\mu^A & 0 \end{pmatrix}, \quad \partial_\mu^A = \begin{pmatrix} \partial_\mu^L & 0 \\ 0 & \partial_\mu^R \end{pmatrix}, \quad (6)$$

can replace an equation (3) for

$$(i\gamma^\mu \partial_\mu^s - m_s)\psi_s = 0. \quad (7)$$

In these circumstances the free Dirac Lagrangian of a C-noninvariant fermion becomes naturally united and behaves as

$$L_{free}^D = \bar{\psi}_s \gamma^5 (i\gamma^\mu \partial_\mu^s - m_s)\psi_s. \quad (8)$$

Furthermore, if we take into account that ∂_μ^s is 4×4 matrix, then (8) at the local axial-vector gauge invariance of matter fields leads to so far unobserved unified mirror principle.

Our purpose in a given work is to formulate this principle and its consequences by studying at the level of a mirror C-noninvariant Dirac Lagrangian the nature of the united interactions between the truly neutral fermion and the field of emission in a latent structure dependence of gauge invariance.

2. Mass structure of axial-vector types of photons

The importance of our notion about an electric charge of a C-noninvariant nature lies in the fact [5] that between leptonic current structural components there exist some paradoxical contradictions, which admit their classification with respect to C-operation. This in turn predicts the classical anapole [8,9] as the C-odd electric charge. It has a crucial value for axial-vector types of local gauge transformations.

One of them expresses, in the Coulomb (C) limit, the idea about that

$$\psi'_s = U_s^C \psi_s, \quad U_s^C = e^{i\beta_s(x_s)\gamma^5}, \quad (9)$$

and the Lagrangian (8) loses at the local phase $\beta_s(x_s)$ his gauge invariance.

For restoration of such a broken symmetry, it is desirable to introduce the photon Coulomb field $A_\mu^s(x_s)$ corresponding in a system to an axial-vector transformation

$$A_\mu^{s'} = A_\mu^s + \frac{i}{e_s} \gamma^5 \partial_\mu^s \beta_s \quad (10)$$

including the Coulomb mirror interaction constants e_s at the level of an electric charge of a C-noninvariant nature.

Insertion of

$$\partial_\mu^s = \partial_\mu^s - e_s A_\mu^s \quad (11)$$

in (8) leads us to the Lagrangian

$$\begin{aligned} L^D &= L_{free}^D + L_{int}^D = \\ &= \bar{\psi}_s \gamma^5 (i\gamma^\mu \partial_\mu^s - m_s) \psi_s - ie_s \bar{\psi}_s \gamma^5 \gamma^\mu \psi_s A_\mu^s. \end{aligned} \quad (12)$$

Its invariance concerning the acting local gauge transformations (9) and (10) becomes possible owing to the interaction with an axial-vector photon Coulomb field of truly neutral types of fermions. But unlike the earlier presentations on the gauge bosons, the field A_μ^s must not in the interaction Lagrangian L_{int}^D be usual massless field. The point is that ∂_μ^s comes forward in (8) as 4×4 matrix, which is absent in a classical C-noninvariant Dirac Lagrangian. Instead it includes the usual quantum energy and momentum operators.

From the point of view of a mirror neutrino of true neutrality, a gauge state such as A_μ^s will indicate to the existence of mass in a photon of an axial-vector nature. In other words, any C-odd left or right fermion field [3] from

$$\psi_s = \begin{pmatrix} \psi \\ \phi \end{pmatrix}, \quad \psi = \begin{pmatrix} \psi_L \\ \psi_R \end{pmatrix}, \quad \phi = \begin{pmatrix} \phi_L \\ \phi_R \end{pmatrix} \quad (13)$$

corresponds in L_{int}^D from the Lagrangian (12) to the coexistence of axial-vector types of photon Coulomb fields of the different components

$$A_\mu^s = \begin{pmatrix} A_\mu \\ B_\mu \end{pmatrix}, \quad A_\mu = \begin{pmatrix} A_\mu^L \\ A_\mu^R \end{pmatrix}, \quad B_\mu = \begin{pmatrix} B_\mu^L \\ B_\mu^R \end{pmatrix}. \quad (14)$$

However, according to a mass-charge duality [10], each type of charge testifies in favor of a kind of inertial mass. The electric (E), weak (W), strong (S) and others the innate masses and charges of a C-odd particle constitute herewith the united rest mass m_s^U and charge e_s^U coinciding with all its mass and charge:

$$m_s = m_s^U = m_s^E + m_s^W + m_s^S + \dots, \quad (15)$$

$$e_s = e_s^U = e_s^E + e_s^W + e_s^S + \dots \quad (16)$$

In their framework, the electric m_s^E part of a truly neutral particle mass arises at the expense of the interaction between it and the field of emission of an axial-vector photon. This does not exclude of course the coexistence, in the case of the Dirac Lagrangian (12), of the axial-vector gauge fields of fermion and photon types. Thereby, it predicts the axial-vector mass expressing the idea of the mentioned experiments [6,7] about neutrino scattering on a nucleus as an indication in favor of that the existence of an axial-vector mirror Minkowski [3] space-time is incompatible with the absence in its construction of any of fundamental symmetries between the fermion and the field of emission.

It is already clear from the foregoing that the left- and right-handed axial-vector photons are of long- and short-lived bosons of true neutrality, respectively. Such a difference in life-times explains the spontaneous mirror symmetry absence, which comes forward in nature of C-noninvariant types of particles and fields as a spontaneity criterion of gauge invariance violation and says about the axial-vector photons of the different components possessing the unidentical masses, energies and momenta. These properties have important consequences for creation of the unified field theory of C-odd particles with an integral spin, because they give the possibility to directly write its latent united equation

$$(\partial_\mu^s \partial_s^\mu + m_s^2) \varphi_s = 0 \quad (17)$$

in which the structure of the boson field $\varphi_s(t_s, \mathbf{x}_s)$ is definitely predicted that

$$\varphi_s = \begin{pmatrix} \varphi \\ \chi \end{pmatrix}, \quad \varphi = \begin{pmatrix} \varphi_L \\ \varphi_R \end{pmatrix}, \quad \chi = \begin{pmatrix} \chi_L \\ \chi_R \end{pmatrix}. \quad (18)$$

The Lagrangian responsible for an equation (17) must have the form

$$L_{free}^B = \frac{1}{2} \varphi_s^* \gamma^5 (\partial_\mu^s \partial_s^\mu + m_s^2) \varphi_s. \quad (19)$$

At a choice of an axial-vector gauge transformation

$$\varphi'_s = U_s^C \varphi_s, \quad U_s^C = e^{i\beta_s(x_s)\gamma^5} \quad (20)$$

having his own local phase $\beta_s(x_s)$, the invariance of the free boson Lagrangian (19) is violated without loss of possibility of further restoration. We can, therefore, introduce an axial-vector field A_μ^s in the presence of a kind of gauge transformation.

Unification of (11) and (19) convinces us here that at the local axial-vector transformations (10) and (20), the Lagrangian

$$\begin{aligned} L^B &= L_{free}^B + L_{int}^B = \\ &= \frac{1}{2} \varphi_s^* \gamma^5 (\partial_\mu^s \partial_s^\mu + m_s^2) \varphi_s + \\ &+ \frac{1}{2} [e_s (\varphi_s^* \gamma^5 \partial_\mu^s \varphi_s A_\mu^s - \varphi_s^* \gamma^5 \partial_s^\mu \varphi_s A_\mu^s) - e_s^2 \varphi_s^* \gamma^5 \varphi_s A_\mu^s A_\mu^s] \end{aligned} \quad (21)$$

steel remains gauge-invariant.

3. Axial-vector photon fields of Coulomb and Newton nature

The Lagrangian L_{int} corresponds in each of (12) and (21) to the same interaction, at which elementary objects interacting with an axial-vector field of emission have C-noninvariant electric charges. But, as stated in (15) and (16), any of electric, weak, strong and other types of

interactions consists of the Coulomb and Newton components [11] responsible for their unification in a unified whole [12]. This does not imply of course that the same local gauge transformation must lead to the appearance simultaneously both of Coulomb and of Newton parts of the same interaction. We have, thus, just a situation when nature itself characterizes each free Lagrangian both from the point of view of charge and from the point of view of mass. Thereby, it admits the existence in any free Dirac or boson Lagrangian not only of a kind of Coulomb (C), but also of a kind of Newton (N) component. It is not excluded therefore that to any type of charge or mass corresponds a kind of gauge transformation.

Such a connection may serve, in the limits of $m_s = m_s^E$ and $e_s = e_s^E$, as an invariance criterion of any Lagrangian of (12) and (21) concerning the action of one more another type of the local axial-vector gauge transformation. One can define the structure of this second type of an axial-vector transformation having the different local phase $\beta_s(\tau_s)$ for fermion ψ_s and boson φ_s fields as follows:

$$\psi'_s = U_s^N \psi_s, \quad U_s^N = e^{i\beta_s(\tau_s)\gamma^5}, \quad (22)$$

$$\varphi'_s = U_s^N \varphi_s, \quad U_s^N = e^{i\beta_s(\tau_s)\gamma^5}. \quad (23)$$

To investigate further, we must choose a particle mass $m_s = -i\partial_\tau^s$ in which

$$\partial_\tau^s = \begin{pmatrix} 0 & \partial_\tau^A \\ \partial_\tau^A & 0 \end{pmatrix}, \quad \partial_\tau^A = \begin{pmatrix} \partial_\tau^L & 0 \\ 0 & \partial_\tau^R \end{pmatrix}. \quad (24)$$

From their point of view, the free Dirac Lagrangian (8) accepts the naturally united form

$$L_{free}^D = i\bar{\psi}_s \gamma^5 (\gamma^\mu \partial_\mu^s + \partial_\tau^s) \psi_s, \quad (25)$$

responsible for an equation

$$(\gamma^\mu \partial_\mu^s + \partial_\tau^s) \psi_s = 0. \quad (26)$$

According to one of its aspects, each axial-vector operator of ∂_μ^s and ∂_τ^s can individually influence on fermion field. This becomes possible owing to the compound structure of a mirror space [3], where any of the left- and right-handed particles is characterized by self space-time coordinates and lifetimes. Therefore, without loss of generality, we conclude that

$$\partial_\mu^s \psi_s = \partial_\mu^s \psi_s(x_s), \quad \partial_\tau^s \psi_s = \partial_\tau^s \psi_s(\tau_s), \quad (27)$$

$$\partial_\mu^s \beta_s = \partial_\mu^s \beta_s(x_s), \quad \partial_\tau^s \beta_s = \partial_\tau^s \beta_s(\tau_s). \quad (28)$$

With the use of the second type of an axial-vector transformation (22), the Newton part with an operator ∂_τ^s must lead to the appearance in the Lagrangian (25) of one of its gauge-noninvariant components and that, consequently, the further restoration of such a broken symmetry requires one to introduce the Newton field $A_\tau^s(\tau_s)$ in conformity with an axial-vector transformation

$$A_\tau^{s'} = A_\tau^s + \frac{i}{m_s} \gamma^5 \partial_\tau^s \beta_s \quad (29)$$

including the Newton mirror interaction constants m_s at the level of an electric mass of an axial-vector nature.

Taking into account (11), (27), (28) and that

$$\partial_\tau^s = \partial_\tau^s - m_s A_\tau^s, \quad (30)$$

from (25), we are led to another new Lagrangian L^D , which is invariant concerning the local axial-vector gauge transformations (9), (10), (22) and (29), because it consists of the following parts of a C-odd Dirac interaction:

$$\begin{aligned} L^D &= L_{free}^D + L_{int}^D = \\ &= i\bar{\psi}_s \gamma^5 (\gamma^\mu \partial_\mu^s + \partial_\tau^s) \psi_s - ie_s j_C^\mu A_\mu^s - im_s j_N^\tau A_\tau^s. \end{aligned} \quad (31)$$

Here j_C^μ and j_N^τ describe the Coulomb and Newton components of the same axial-vector photon leptonic current

$$j_C^\mu = \bar{\psi}_s \gamma^5 \gamma^\mu \psi_s, \quad (32)$$

$$j_N^\tau = \bar{\psi}_s \gamma^5 \psi_s. \quad (33)$$

One of the most highlighted features of these types of currents is their unity, which involves the commutativity conditions of the matrices γ^5 , ∂_μ^s and ∂_τ^s expressing the idea of the coexistence law of the continuity equations

$$\partial_\mu^s j_C^\mu = 0, \quad (34)$$

$$\partial_\tau^s j_N^\tau = 0. \quad (35)$$

Simultaneously, as is easy to see, the field A_μ^s and

$$A_\tau^s = \begin{pmatrix} A_\tau \\ B_\tau \end{pmatrix}, \quad A_\tau = \begin{pmatrix} A_\tau^L \\ A_\tau^R \end{pmatrix}, \quad B_\tau = \begin{pmatrix} B_\tau^L \\ B_\tau^R \end{pmatrix} \quad (36)$$

arise in (31) as the Coulomb and Newton parts of the same axial-vector photon field.

The structure itself of the Lagrangian L_{int}^D in (31) testifies in addition that at the availability of an interaction Newton component with an axial-vector photon field, a neutrino of true neutrality must possess an axial-vector electric mass. Insofar as its C-noninvariant electric charge is concerned, it appears in the Coulomb part dependence of the same interaction.

The quantum mass operator in turn transforms (19) into a latent united Lagrangian of the unified field theory of C-odd bosons with a nonzero spin

$$L_{free}^B = \frac{1}{2} \varphi_s^* \gamma^5 (\partial_\mu^s \partial_s^\mu - \partial_\tau^s \partial_s^\tau) \varphi_s. \quad (37)$$

This connection suggests his new equation

$$(\partial_\mu^s \partial_s^\mu - \partial_\tau^s \partial_s^\tau) \varphi_s = 0 \quad (38)$$

and thereby confirms the fact that the operators ∂_μ^s and ∂_τ^s can individually influence on fermion as well as on boson field

$$\partial_\mu^s \varphi_s = \partial_\mu^s \varphi_s(x_s), \quad \partial_\tau^s \varphi_s = \partial_\tau^s \varphi_s(\tau_s). \quad (39)$$

Uniting (37) with (11), (30) and having in mind (28) and (39), we find that the Lagrangian L^B invariant concerning the local axial-vector gauge transformations (9), (10), (23) and (29) must contain the following components of a C-noninvariant boson interaction:

$$\begin{aligned} L^B &= L_{free}^B + L_{int}^B = \\ &= \frac{1}{2} \varphi_s^* \gamma^5 (\partial_\mu^s \partial_s^\mu - \partial_\tau^s \partial_s^\tau) \varphi_s + \\ &+ \frac{1}{2} [e_s (J_\mu^C A_\mu^s - J_C^\mu A_\mu^s) - e_s^2 \varphi_s^* \gamma^5 \varphi_s A_\mu^s A_\mu^s] - \end{aligned}$$

$$-\frac{1}{2}[m_s(J_\tau^N A_s^\tau - J_N^\tau A_\tau^s) - m_s^2 \varphi_s^* \gamma^5 \varphi_s A_\tau^s A_s^\tau]. \quad (40)$$

Coulomb and Newton electric currents, $J_C^\mu(J_\mu^C)$ and $J_N^\tau(J_\tau^N)$, interacting with axial-vector fields $A_\mu^s(A_\mu^\mu)$ and $A_\tau^s(A_\tau^\tau)$ respectively, constitute the two parts of the same axial-vector boson current

$$J_C^\mu = \varphi_s^* \gamma^5 \partial_s^\mu \varphi_s, \quad J_\mu^C = \varphi_s^* \gamma^5 \partial_\mu^s \varphi_s, \quad (41)$$

$$J_N^\tau = \varphi_s^* \gamma^5 \partial_\tau^\tau \varphi_s, \quad J_\tau^N = \varphi_s^* \gamma^5 \partial_\tau^s \varphi_s. \quad (42)$$

As well as in the systems of axial-vector leptonic currents, conservation of each boson current here must carry out itself as a consequence of the coexistence law of the continuity equations

$$\partial_\mu^s J_C^\mu = 0, \quad \partial_\mu^\mu J_\mu^C = 0, \quad (43)$$

$$\partial_\tau^s J_N^\tau = 0, \quad \partial_\tau^\tau J_\tau^N = 0. \quad (44)$$

In particular, about sizes of m_s and e_s should be mentioned, corresponding in the Lagrangian (40) to the fact that owing to the interaction with the Newton A_τ^s and Coulomb A_μ^s fields of the same axial-vector photon, any of truly neutral bosons with a nonzero spin must possess simultaneously each of axial-vector types of electric mass and charge. Such a boson can, for example, be photon itself. It is not surprising therefore that $m_s^2 A_\tau^s A_\tau^\tau$ and $e_s^2 A_\mu^s A_\mu^\mu$ describe in (40) its Newton and Coulomb interactions with another photon of an axial-vector nature.

In both Lagrangians (31) and (40), as is now well known, the mass m_s and charge e_s , which are present in them jointly with a kind of axial-vector photon field, appear in the mass-charge structure dependence of gauge invariance, so that there exist the axial-vector tensors

$$F_{\mu\lambda}^C = \partial_\mu A_\lambda^C - \partial_\lambda A_\mu^C, \quad (45)$$

$$F_{\tau\sigma}^N = \partial_\tau A_\sigma^N - \partial_\sigma A_\tau^N. \quad (46)$$

In their presence, the structure of the Lagrangian of the unified field theory of C-odd neutrinos and particles with an integral spin has fully definite form

$$\begin{aligned} L = & i\bar{\psi}_s \gamma^5 (\gamma^\mu \partial_\mu^s + \partial_\tau^s) \psi_s + \\ & + \frac{1}{2} \varphi_s^* \gamma^5 (\partial_\mu^s \partial_s^\mu - \partial_\tau^s \partial_s^\tau) \varphi_s - \\ & - \frac{1}{4} F_{\mu\lambda}^C F^{\mu\lambda}_C + \frac{1}{4} F_{\tau\sigma}^N F^{\tau\sigma}_N - ie_s j_C^\mu A_\mu^s - im_s j_N^\tau A_\tau^s + \\ & + \frac{1}{2} [e_s (J_\mu^C A_\mu^\mu - J_\mu^\mu A_\mu^s) - e_s^2 \varphi_s^* \gamma^5 \varphi_s A_\mu^s A_\mu^\mu] - \\ & - \frac{1}{2} [m_s (J_\tau^N A_\tau^\tau - J_\tau^\tau A_\tau^s) - m_s^2 \varphi_s^* \gamma^5 \varphi_s A_\tau^s A_\tau^\tau]. \end{aligned} \quad (47)$$

Its components reflect just the fact that each of axial-vector types of fermions or bosons possesses a C-noninvariant electric charge at the interaction with the Coulomb A_μ^s field of an axial-vector photon. This in turn implies the origination of an axial-vector electric mass of the investigated particles as a consequence of their interaction with the Newton A_τ^s field of the same type of photon.

We recognize that a characteristic part of the standard model [13-15] is the chiral presentation of the Weyl [16] in which a matrix γ_5 allows one to choose only the left components of the fermion

field. In this situation, the presence of mass of any particle in the interaction Lagrangian violates its gauge invariance.

At first sight, such a violation requires the existence of one more another type of the scalar boson [17] responsible for origination in the Lagrangian of mass of the interacting particles and fields. This, however, is not in line with nature, since the availability in it of the second type of the local transformation expressing the idea of the mass structure [18] of gauge invariance has not been known before the creation of the first-initial electroweak theory.

4. Conclusion

Another bright feature of axial-vector mass, energy and momentum is that they together with a relation

$$E_s = \frac{\mathbf{p}_s^2}{2m_s} \quad (48)$$

constitute a C-noninvariant equation of quantum mechanics

$$\partial_t^s \psi_s \partial_\tau^s \psi_s - \frac{1}{2} \partial_{\mathbf{x}}^s \psi_s \partial_{\mathbf{x}}^s \psi_s = 0. \quad (49)$$

As well as in (26) and (38), axial-vector operators ∂_t^s and $\partial_{\mathbf{x}}^s$ can individually influence here on matter field

$$\partial_t^s \psi_s = \partial_t^s \psi_s(t_s), \quad \partial_{\mathbf{x}}^s \psi_s = \partial_{\mathbf{x}}^s \psi_s(\mathbf{x}_s). \quad (50)$$

At these situations, (26) can be established with the use of the Lagrangian (25) and the Euler-Lagrange equation. Of course, this equation [19] at the level of the mass-charge structure of gauge invariance has the following form:

$$\partial_\mu^s \left(\frac{\partial L_{free}^D}{\partial(\partial_\mu^s \overline{\psi}_s(x_s))} \right) + \partial_\tau^s \left(\frac{\partial L_{free}^D}{\partial(\partial_\tau^s \overline{\psi}_s(\tau_s))} \right) = \frac{\partial L_{free}^D}{\partial \overline{\psi}_s(x_s)} + \frac{\partial L_{free}^D}{\partial \overline{\psi}_s(\tau_s)}. \quad (51)$$

It states that

$$\partial_\tau^s \partial_\mu^s \psi_s(x_s) = 0, \quad \partial_\tau^s \psi_s(\tau_s) \partial_\mu^s \psi_s(x_s) \neq 0, \quad (52)$$

$$\partial_\mu^s \partial_\tau^s \psi_s(\tau_s) = 0, \quad \partial_\mu^s \psi_s(x_s) \partial_\tau^s \psi_s(\tau_s) \neq 0. \quad (53)$$

A fundamental role in nature of nonelectric components of axial-vector mass and charge of truly neutral neutrinos and bosons with a nonzero spin and some above unnoted aspects of new equations of their unified field theory call for special presentation.

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